Space Weather Technical Forecast

Issued on Friday, 03 February 2023 at 12:38 Local

This technical forecast provides a four day assessment of space weather events. The probabilities stated below are for reaching or exceeding the given levels. For more information about space weather impacts please see the Met Office Space Weather Scales https://www.metoffice.gov.uk/weather/learn-about/space-weather/uk-scales

Space Weather Forecast Headline: Slight chance of M-flares. Slight chance of G1/Minor Storm, mainly on Days 3 and 4 (05-06 Feb).

Analysis of Space Weather Activity over past 24 hours
Solar Activity: Activity has been Low, with isolated minor C-class flares in the past 24 hours. There are currently five sunspot regions on the disc. All of these are small and magnetically simple, although some minor development has been observed. No Earth-directed CMEs have been seen in available imagery.

Solar Wind / Geomagnetic Activity: Solar wind parameters, as observed by DSCOVR at L1, have shown the recent High Speed Stream (HSS) waning to background levels, with a possible CME arrival at 03/1050 UTC. Wind speeds have declined from slightly elevated levels near 420 km/s to ambient levels around 340-370 km/s. Density has been average to below average but increased slightly as the CME arrived. The total IMF strength, Bt, was weak at 7nT or below before jumping to moderate as the CME arrived. The north-south component (Bz) varied weakly between +9/-5 nT. The Phi angle was mostly negative (towards the Sun). Geomagnetic activity was Quiet (Kp 0-2).

Energetic Particles / Solar Radiation: The high energy proton flux (greater than 10 MeV) as measured at GOES-16 has been at background levels throughout. High energy electron flux (greater than 2MeV) measured by GOES-16 was at background levels. The associated 24 hour electron fluence declined through the period, with 1.47e6 integrated pfu observed at 03/0001 UTC.

Four-Day Space Weather Forecast Summary
Solar Activity: Low activity is forecast with the sunspots on the visible disc currently small and relatively simple. There is a slight chance of M-class flares.

Solar Wind / Geomagnetic Activity: The recent weak CME arrival is likely to have been that launched on the 30 Jan, with minor CME effects likely continuing through the coming 24 hours. Wind speeds are currently at ambient levels, and are expected to remain so through Days 1 and 2 (03-04 Feb). The next feature of interest is CH74/- which is likely to bring elevated wind speeds. It currently seems most likely to arrive on Day 3, but with significant uncertainty in this. Geomagnetic activity is expected to be mainly Quiet to Unsettled throughout. There is a chance of Active intervals and a slight chance of a G1/Minor Storm interval, most likely on Day 1 with the current weak CME effects and on Days 3 or 4 as the HSS arrives.

Energetic Particles / Solar Radiation: The high energy (greater than 10 MeV) proton flux observed by GOES-16 is expected to remain at background levels. Electron flux is expected to be at mostly background levels. Electron fluence is expected to remain below the Active (1e8 integrated pfu) threshold.

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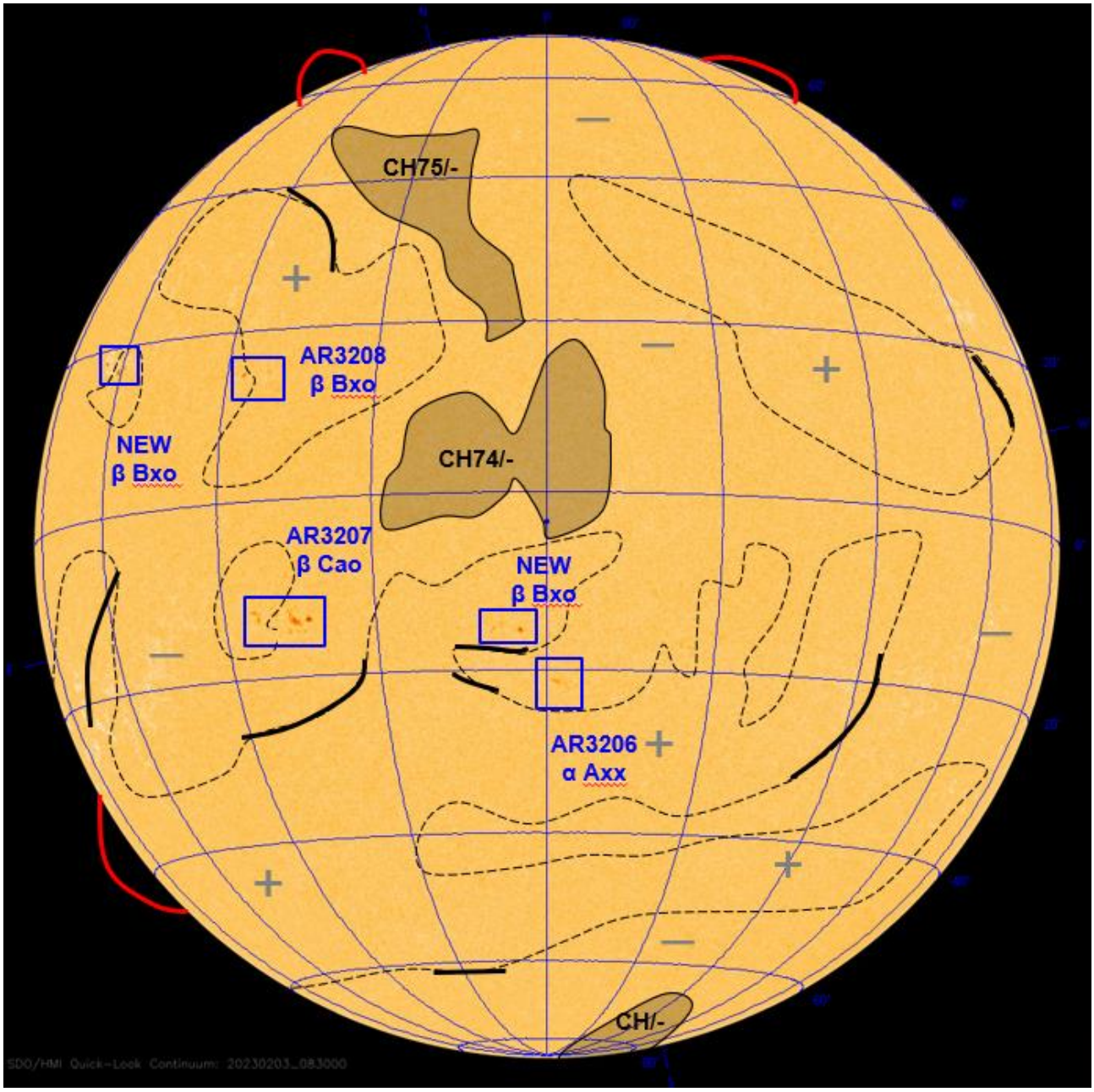
Figure 1. Solar Analysis Valid 03/0800 UTC.



Key: Filament ___ , Prominence ___ , Magnetic Field Line - - - , Polarity +/-, Coronal Holes: Grey shaded area CHxx +/-, Sunspot groups 25xx - Mt Wilson α-β-βγ-βγδ and Zurich-McIntosh Axx etc.

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Geomagnetic Storms:

The recent weak CME arrival is likely to have been that launched on the 30 Jan, with minor CME effects likely continuing through the coming 24 hours.

Wind speeds are currently at ambient levels, and are expected to remain so through Days 1 and 2 (03-04 Feb). The next feature of interest is CH74/- the leading edge of which is just west of centre disc, which is likely to bring elevated wind speeds. The timing of the arrival of any HSS is low confidence, with Enlil suggesting an arrival during Day 1, but empirical and persistence methods suggesting this won't occur until later Day 3 or on Day 4 (05-06 Feb). As such it seems most likely to arrive on Day 3, but with significant uncertainty in this.

Geomagnetic activity is expected to be mainly Quiet to Unsettled throughout. There is a chance of Active intervals and a slight chance of a G1/Minor Storm interval, most likely on Day 1 with the current weak CME effects and on Days 3 or 4 as the HSS arrives.

Geo-Magnetic Storm Probability (Exceedance)	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Minor or Moderate	G1 to G2	No	20	5	20	20
Strong	G3	No	1	1	1	1
Severe	G4	No	1	1	1	1
Extreme	G5	No	1	1	1	1

Geomagnetic Activity - Earthbound Coronal Mass Ejections

Date/time 21.5R (UTC)	Halo: Full or Partial	Source	Source Location	Estimated Speed	Estimated Arrival Time	Comments
*	*	*	*	*	*	*

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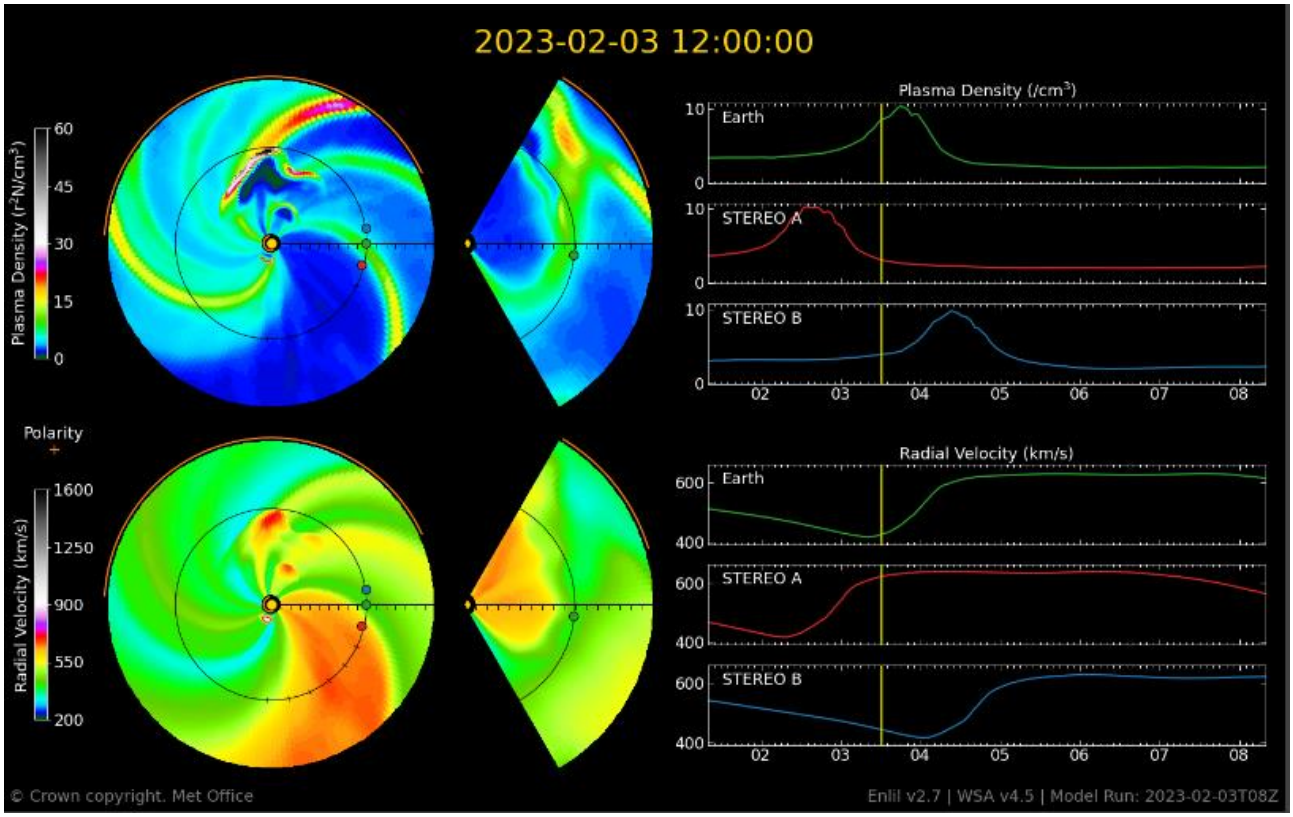
Figure 2: MOSWOC Enlil showing a HSS arrival later on Day 1 (03 Feb), which seems much too early in comparison with the location of the coronal hole on the disc.



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Radio Blackouts - X-Ray Flares:

There are five sunspot regions on the visible disc, however these are all small and magnetically simple. Some minor growth has been seen in the last 24 hours, but nothing significant. Activity is expected to remain Low with only a slight chance of increasing to Moderate with any M-flares that occur.

STEREO-A EUV imagery shows some bright flux due to rotate onto the southeast limb within the next day or so. This is supported by helioseismograph data, which shows the potential for further regions to rotate onto the disc through the period.

X Ray Flares	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC)	Day 2 (00-24 UTC)	Day 3 (00-24 UTC)	Day 4 (00-24 UTC)
Probability			(%)	(%)	(%)	(%)
Active	R1-R2 M Class	No	10	10	10	10
Very Active	R3 to R5 X Class	No	1	1	1	1

Solar Radiation Storms - (High Energy Protons):

High energy (greater than 10MeV) proton flux as observed by GOES16 is currently expected to persist at background levels.

Radiation Storms	Level (cm^{-2} sr^{-1} s^{-1})	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC)	Day 2 (00-24 UTC)	Day 3 (00-24 UTC)	Day 4 (00-24 UTC)
Probability (Exceedance)			(%)	(%)	(%)	(%)
Active	≥ S1	No	1	1	1	1
Very Active	≥ S3 *	No	1	1	1	1

* S3 ≥ 10 MeV ≥ 1000 pfu and / or ≥ 50 MeV ≥ 10 pfu. (pfu = $cm^{-2}sr^{-1}s^{-1}$)

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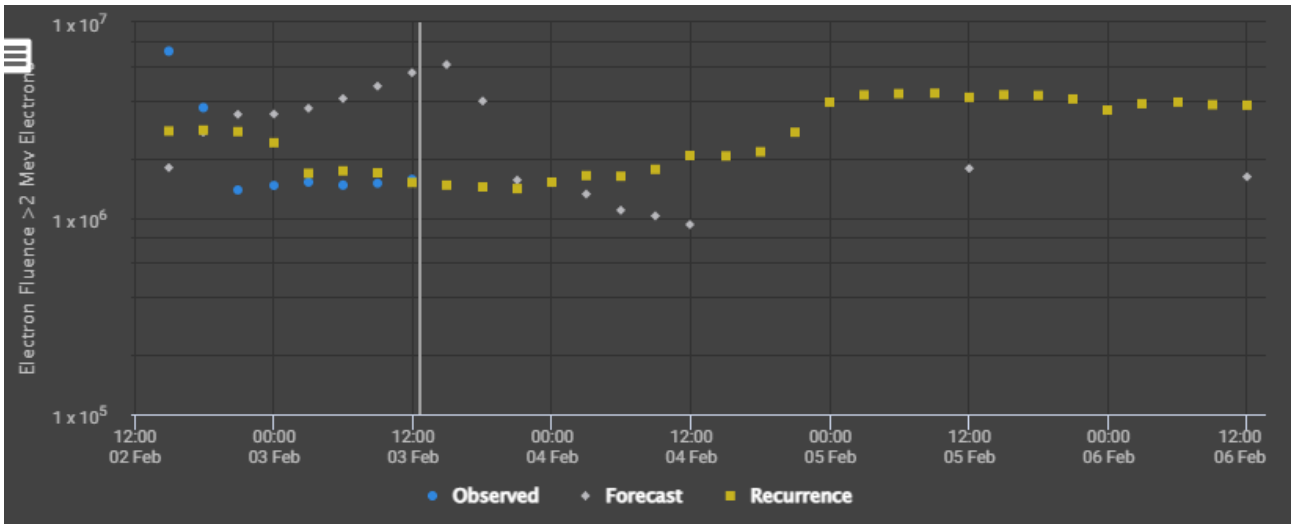
High Energy Electrons Event (≥ 2MeV):
High energy electron flux (greater than 2MeV) as observed by GOES-16 is now at background levels and is likely to remain so through at least the next day due to current CME effects after a recent arrival with reasonable confidence. A slight rise is possible through Day 2 into Day 3 (04-05 Feb) but with very low confidence. A further HSS is likely towards the end of the period although there is low confidence in the timing (see geomagnetic storm section). This is expected to suppress flux levels once again by the very end of the period.

Electron fluence is expected to remain well below the Active (1e8 integrated pfu) threshold. A slight rise is possible, but unlikely. This is supported by MOSWOC REFM which is forecasting a steady trend well below Active.

GEO Electron Environment Probability (Exceedance)	Level ($cm^{-2}\ sr^{-1}\ day^{-1}$)	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Active	**≥ 2 MeV ≥ $1x10^8$**	No	1	5	5	5
Very Active	**≥ 2 MeV ≥ $1x10^9$**	No	1	1	1	1

Figure 3: MOSWOC REFM showing a steady trend well below the Active (1e8 integrated pfu) threshold, which seems like good guidance.



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